Beyond Network Management

Using Real-time CORBA in Optical Switching Infrastructures

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Introduction

- Trends in Communications
- CORBA and Network Management
- Challenges in Building Optical Switches
- Using Real-time CORBA in Optical Switches
- Summary

Trends in Communications

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Trends in Communications

- **High-speed Optical Switches**
  - Bigger, faster, and *dumber*
- **IP-based Services**
- **New Applications**
  - Live, high-definition video
  - Virtual Private Networks (VPN)
  - Differentiated Internet access
- **Changing Business Models**
  - Bandwidth-on-demand
  - Contractually mandated service levels
  - Customer self-provisioning and self-management
  - Operations streamlining: more services with less staff

Trends in Communications: New Requirements

- Requires automated and dynamic provisioning of
  - Ports
    - Existing connections used for dynamic creation of new virtual circuits
    - Virtually plug in and connect Joe and Fred
    - They instantly know about each other
    - Hardware provisioning delegated to the home or office
    - Flexible capacity management
  - Wavelength Resources
    - Allocation
    - Provisioning
  - Priority policies
- Requires predictable *and* dynamic service levels
  - Allows service providers to offer differentiated services
  - Allows diverse, multi-level service agreements
    - From guaranteed, fixed bandwidth … to excess capacity use … to …
    - Requires control of both implicit and explicit service levels

Trends in Communications New Requirements (2)

- **Require software-centric system architectures**
- **Need to assimilate new technologies**
  - Migrate quickly and easily to that new cool, fast hardware
- **Reduce time-to-market for new products**
- **Increase product innovations**
- **Allow systems to become policy driven**
  - QoS, load balancing, routing, backup, security, etc.
- **Communications has come to the door of real-time**
  - Market leaders will set themselves apart by the timeliness of how they allocate bandwidth and move data

CORBA in Network Management

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CORBA and Network Management (1)

- **Telecom early use of Simple Network Management Protocol (SNMP)**
  - Management Information Base (MIB)
  - Common Management Information Protocol (CMIP)
  - Common Management Information System Element (CMISE)
    - Was industry standard
- **Problems included**
  - No location transparency
  - Poor portability/interoperability
  - Products are cost prohibitive (developer and run-time)
- **CORBA was a better alternative**

CORBA and Network Management (2)

- Was there a natural progression from CMIP to IDL?
- The CMIP guidelines for Definition of Managed Objects (GDMO) could be abstracted at either high or low levels
  - Depends on the size and requirements of the applications
- CORBA is the emerging industry standard for Telecom Network Management
  - Cost effective
  - Well educated culture (tools, doc, available engineers)
  - Good fit to future technologies (ATM, IP applciations)
- IDL provides a type safe and understandable interface to customers

Challenges in Building Optical Switches

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Challenges in Building Optical Switches

- **Integrating Legacy Technologies**
  - Integrate heterogeneous hardware
    - Use custom transport technologies
    - New hardware talks to old hardware
  - Integrate heterogeneous operating systems
    - Universal model of thread priority
    - New O/S's interoperate with old O/S's
  - Integrate heterogeneous programming languages
    - C, C++, Java, …
    - Latest languages talking to old languages

Challenges in Building Optical Switches (2)

- **Flexibility vs. Performance Tug-of-war**
  - Optical switches must be really *fast*
    - Low latency + high bandwidth
    - Quick, easy solution is to make them dumb
      - Hardware centric, disposable software
      - Software functionality must play catch-up
  - But flexibility+speed will win in the long run
    - Better address business needs of service providers
    - Dramatically better time-to-market for new hardware innovations
    - New product introductions can be software-only

Using Real-Time CORBA in Optical Switches

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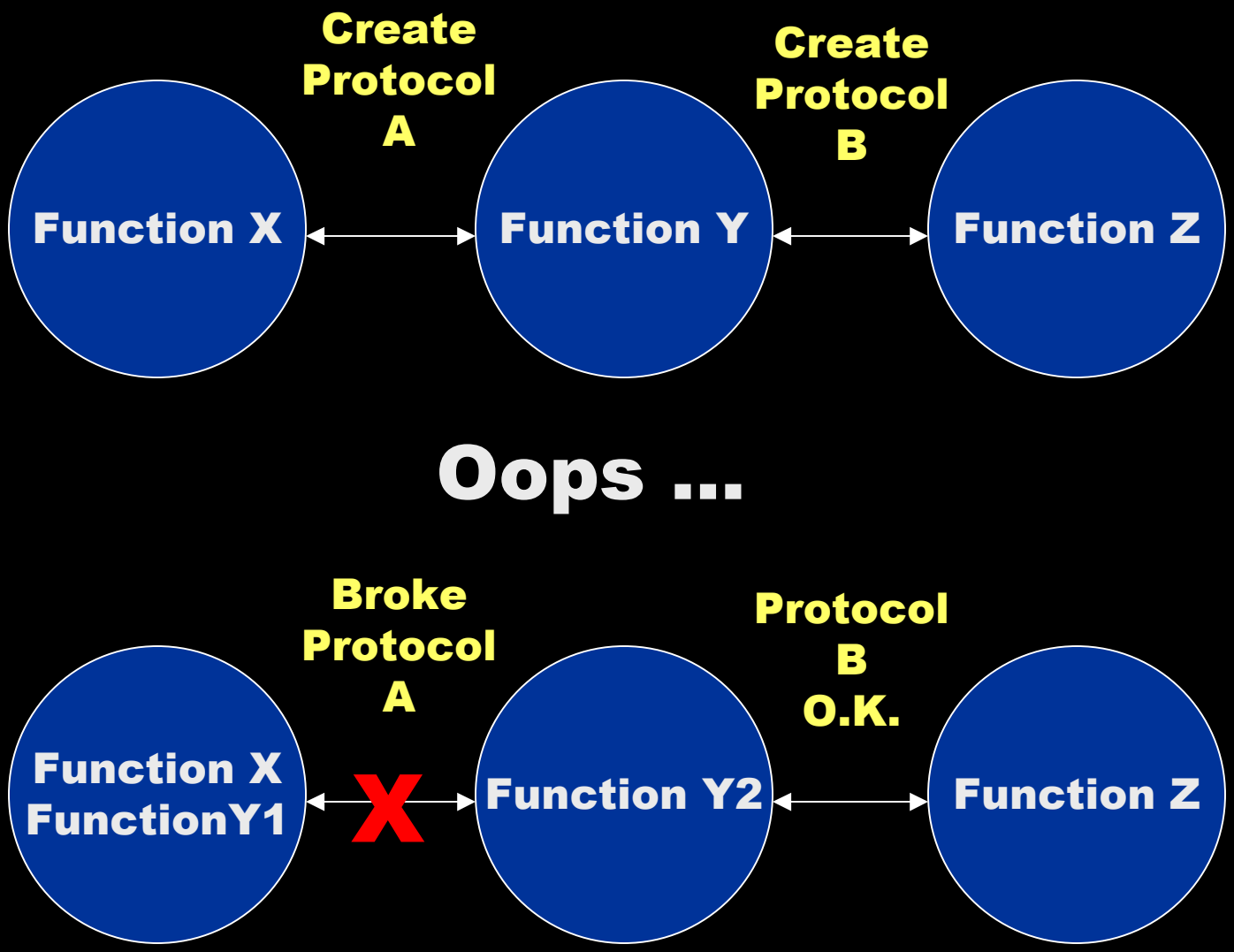
Understanding CORBA Flexibility



Understanding CORBA Flexibility (2)

- **Think of X, Y and Z as relocatable, distributed objects**
- **Therefore these objects can reside anywhere on your network**
  - This includes a single process space (collocation)
    - Very fast (70 nsec for a virtual function call)
    - Can be used as a test bed
  - Same host or different host
  - Same language or different different language
- **Applications don't care where the objects reside they make calls to the client side API**
  - Just like a C, C++ or Java program

Real-time CORBA

- **Real-time CORBA adds control of *time***
- **Priority banded connections**
  - Reduce/bound priority inversions
  - Priorities are respected on both sides of the remote call
- **Priority insures latency requirements which might be separate from bandwidth considerations**
  - High priority, low latency, moderate bandwidth
  - Moderate-to-low priority, high latency, high bandwidth
- **RTCORBA priorities map to RTOS priorities**
  - Can be altered via custom mapping function
- **End-to-End predictability**

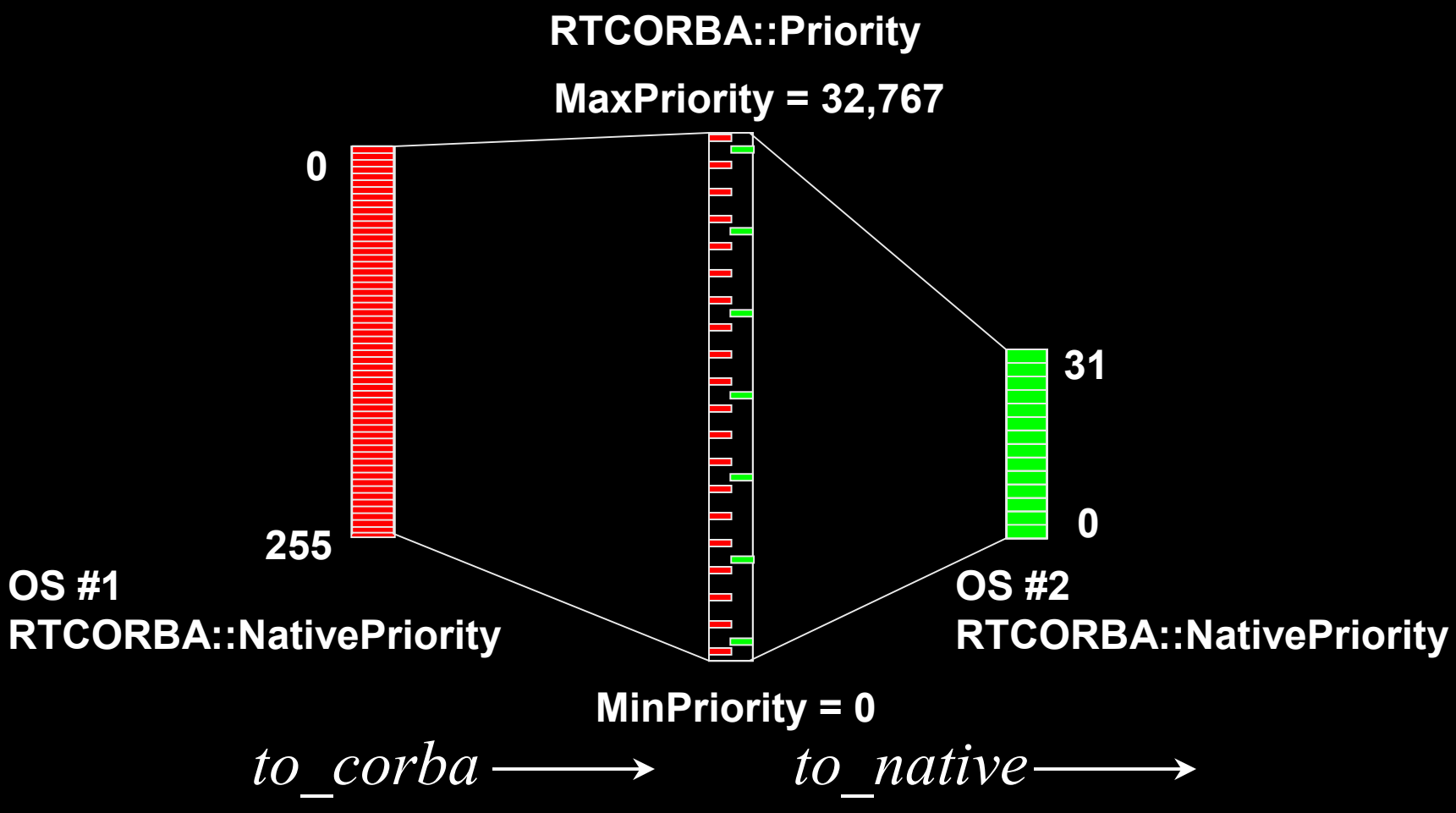
Using Real-Time CORBA in Optical Switches

- **Real-time ORBs can provide both:**
  - Real-Time CORBA = Performance + Flexibility
  - Unparalleled flexibility
  - Low latency and high throughput (some RT ORBs)
- **New hardware doesn't have to mean a rebuild**
  - Change backplanes/buses without changing software
    - VME – PCI – USB – Switched Fabric – …
  - Allow switch to extend over non-backplane technologies
    - ATM
    - Ethernet (10Mb, 100Mb, 1Gb, 10Gb, …)
    - Fibre Channel
    - IEEE 1394
    - …

Using Real-Time CORBA in Optical Switches (2)

- Plug in a custom transport into the RT ORB
  - Only a few engineers need understand the transport details
- RT CORBA application code doesn't change to use new transport

Integrate Operating Systems RT CORBA Priority Mapping



Summary

- **Real-time ORB's allow for better optical switches**
  - Faster
  - More flexible
  - Extensible
  - More easily adapted to new hardware
  - Better leveraging of legacy technologies

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OBJECTIVE INTERFACE

End of Presentation